

(19)



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(11)

EP 0 718 398 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

26.06.1996 Bulletin 1996/26

(51) Int. Cl.⁶: **C11D 3/39, C11D 3/36**(21) Application number: **94870206.3**(22) Date of filing: **22.12.1994**

(84) Designated Contracting States:

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N.V.**Temselaan 100****1853 Strombeek-Bever (BE)**(54) **Laundry bleaching compositions**

(57) The present invention relates to a laundry bleaching composition comprising a peroxy compound present in an effective amount to cause bleaching; a manganese-containing bleach catalyst present in an effective amount to activate the peroxy compound; characterized in that the compositions further contain an agent capable of binding manganese which molecule contains at least 3 nitrogen atoms or at least 2 nitrogen atoms and an oxygen atom, in a molar ratio to the bleach catalyst of from 0.2:1 to 500:1, preferably 1:1 to 250:1, and that, the composition further contains from 0.01 to 2% of a metal ion selected from magnesium, calcium, strontium, zinc and aluminium, and/or the manganese-containing bleach catalyst and the agent capable of binding manganese are present as an intimate mixture; preferred manganese-binding agents include diethylene triamine penta (methylene phosphonic acid), diethylene triamine pentaacetic acid, and diethylenetriamine.

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DescriptionTechnical Field

5 The present invention relates to laundry bleaching compositions useful for laundering fabrics, comprising a manganese bleach catalyst.

Background of the Invention

10 Metal-containing catalysts have been described in bleach compositions, including manganese-containing catalysts such as those described in EPA 549 271; EPA 549 272; EPA 458 397; US 5,246,621; EPA 458 398; US 5,194,416; and US 5,114,611. These bleach catalysts are described as being active for catalyzing the bleaching action of peroxy compounds against various stains. Several of these bleaching systems are said to be effective for use in washing and bleaching of substrates, including laundry and hard surfaces (such as machine dishwashing, general cleaning) and in the
15 textile, paper and wood pulp industries. Both pre-formed species and species formed in situ are described.

It has been discovered that these metal-containing bleach catalysts, especially the manganese-containing catalysts, have the particularly undesirable property, when used with textiles, of damaging the fabric resulting in loss of tensile strength of the fibers and/or producing color damage to the fabric. Obviously, such properties for compositions is a drawback to the general use of these compositions in the laundry area.

20 On the other hand, chelating agents for metal ions are a well known component of laundry detergent compositions; in particular of bleach-containing detergent compositions.

The simultaneous presence of chelating agents capable of binding, inter alia, manganese in catalysts such as described above in detergent compositions, would, however, seem inconsistent to the man skilled in the art, and while certain compounds known as chelants are sometimes mentioned as bleach stabilizers in some of the applications mentioned above, their use in conjunction with manganese-containing catalysts is not taught nor encouraged.

It has now been surprisingly found that the presence of such chelants, and more in general of agents capable of binding manganese, not only is not detrimental to the pre-formed catalyst performance, as the stain removal performance of the compositions is maintained and even increased in some cases, but considerably reduces the fabric damage resulting from the use of said catalysts in the laundry process.

30 It has been further found that, in order to achieve such benefits, either the presence in the composition of metal ion stabilizers for the manganese binding agent is required, or the pre-formed manganese catalyst and the manganese binding agent have to be introduced in the composition as an intimate mixture.

These and other objects are secured herein, as will be seen from the following disclosures.

35 Summary of the Invention

A laundry bleaching composition comprising a peroxy compound present in an effective amount to cause bleaching; a manganese-containing bleach catalyst present in an effective amount to activate the peroxy compound; characterized in that the compositions further contain an agent capable of binding manganese which molecule contains at least 3
40 nitrogen atoms or at least 2 nitrogen atoms and an oxygen atom, in a molar ratio to the bleach catalyst of from 0.2:1 to 500:1, preferably 1:1 to 250:1, and that, either the composition further contains from 0.01 to 2% of a metal ion selected from magnesium, calcium, strontium, zinc and aluminium, and/or the manganese-containing bleach catalyst and the agent capable of binding manganese are present as an intimate mixture.

45 Detailed Description of the InventionForm of the composition

50 The compositions herein can be in the form of a granular or liquid laundry detergent composition, or in the form of a granular or liquid additive for laundry detergent compositions; essential as well as optional ingredients are described in detail hereinbelow :

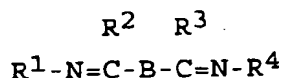
The Manganese-containing Bleach Catalyst:

55 The pre-formed bleach catalysts useful herein include the manganese-based complexes disclosed in U.S. Pat. 5,246,621 and U.S. Pat. 5,244,594. Preferred examples of these catalysts include $Mn^{IV}_2(u-O)_3(1,4,7\text{-trimethyl-}1,4,7\text{-triazacyclononane})_2(PF_6)_2$, $Mn^{III}_2(u-O)_1(u-OAc)_2(1,4,7\text{-trimethyl-}1,4,7\text{-triazacyclononane})_2(ClO_4)_2$, $Mn^{IV}_4(u-O)_8(1,4,7\text{-triazacyclononane})_4(ClO_4)_4$, $Mn^{III}Mn^{IV}(u-O)_1(u-OAc)_2(1,4,7\text{-trimethyl-}1,4,7\text{-triazacyclononane})_2(ClO_4)_3$, and mixtures thereof. Others are described in European patent application publication no. 549,272. Other ligands suitable for use

herein include 1,5,9-trimethyl-1,5,9-triazacyclododecane, 2-methyl-1,4,7-triazacyclononane, 2-methyl-1,4,7-triazacyclononane, 1,2,4,7-tetramethyl-1,4,7-triazacyclononane, and mixtures thereof. Also included are the mononuclear manganese (IV) complexes such as $\text{Mn}^{\text{IV}}(1,4,7\text{-trimethyl-1,4,7-triazacyclononane})(\text{OCH}_3)_3(\text{PF}_6)$ as described in U.S. Pat 5,194,416.

Still another type of bleach catalyst, as disclosed in U.S. Pat. 5,114,606, is a water-soluble complex of manganese (II), (III), and/or (IV) with a ligand which is a non-carboxylate polyhydroxy compound having at least three consecutive C-OH groups. Preferred ligands include sorbitol, iditol, dulcitol, mannitol, xylitol, arabitol, adonitol, meso-erythritol, meso-inositol, lactose, and mixtures thereof.

U.S. Pat. 5,114,611 teaches a bleach catalyst comprising a complex of transition metals, including Mn, with a non-(macro)-cyclic ligand. Said ligands are of the formula:



wherein R^1 , R^2 , R^3 , and R^4 can each be selected from H, substituted alkyl and aryl groups such that each $\text{R}^1 - \text{N} = \text{C} - \text{R}^2$ and $\text{R}^3 - \text{C} = \text{N} - \text{R}^4$ form a five or six-membered ring. Said ring can further be substituted. B is a bridging group selected from O, S, CR^5R^6 , NR^7 and $\text{C}=\text{O}$, wherein R^5 , R^6 , and R^7 can each be H, alkyl, or aryl groups, including substituted or unsubstituted groups. Preferred ligands include pyridine, pyridazine, pyrimidine, pyrazine, imidazole, pyrazole, and triazole rings. Optionally, said rings may be substituted with substituents such as alkyl, aryl, alkoxy, halide, and nitro. Particularly preferred is the ligand 2,2'-bispyridylamine.

Other examples include Mn gluconate, $\text{Mn}(\text{CF}_3\text{SO}_3)_2$, $\text{Co}(\text{NH}_3)_5\text{Cl}$, and the binuclear Mn complexed with tetra-N-dentate and bi-N-dentate ligands, including $\text{N}_4\text{Mn}^{\text{III}}(\text{u-O})_2\text{Mn}^{\text{IV}}\text{N}_4$ and $[\text{Bipy}_2\text{Mn}^{\text{III}}(\text{u-O})_2\text{Mn}^{\text{IV}}\text{bipy}_2](\text{ClO}_4)_3$.

The pre-formed bleach catalysts of the present invention may also be prepared by combining a water-soluble ligand with a water-soluble manganese salt in aqueous media and concentrating the resulting mixture by evaporation. Any convenient water-soluble salt of manganese can be used herein. Manganese (II), (III), (IV) and/or (V) is readily available on a commercial scale. In some instances, sufficient manganese may be present in the wash liquor, but, in general, it is preferred to add Mn cations in the compositions to ensure its presence in catalytically-effective amounts. Thus, the sodium salt of the ligand and a member selected from the group consisting of MnSO_4 , $\text{Mn}(\text{ClO}_4)_2$ or MnCl_2 (least preferred) are dissolved in water at molar ratios of ligand:Mn salt in the range of about 1:4 to 4:1 at neutral or slightly alkaline pH. The water may first be de-oxygenated by boiling and cooled by sparging with nitrogen. The resulting solution is evaporated (under N_2 , if desired) and the resulting solids are used in the bleaching and detergent compositions herein without further purification.

While the structures of the bleach-catalyzing manganese complexes of the present invention have not been elucidated, it may be speculated that they comprise chelates or other hydrated coordination complexes which result from the interaction of the carboxyl and nitrogen atoms of the ligand with the manganese cation. Likewise, the oxidation state of the manganese cation during the catalytic process is not known with certainty, and may be the (+II), (+III), (+IV) or (+V) valence state. Due to the ligands' possible six points of attachment to the manganese cation, it may be reasonably speculated that multi-nuclear species and/or "cage" structures may exist in the aqueous bleaching media. Whatever the form of the active Mn • ligand species which actually exists, it functions in an apparently catalytic manner to provide improved bleaching performances on stubborn stains such as tea, ketchup, coffee, blood, and the like.

Other manganese bleach catalysts are described, for example, in U.S. 4,728,455 (manganese/multidentate ligand catalyst), U.S. 4,711,748 and European patent application, publication no. 224,952, (absorbed manganese on aluminosilicate catalyst), U.S. 4,601,845 (aluminosilicate support with manganese and zinc or magnesium salt), U.S. 4,626,373 (manganese/ligand catalyst), U.S. 4,430,243 (chelants with manganese cations and non-catalytic metal cations), and U.S. 4,728,455 (manganese gluconate catalysts).

The manganese bleach catalyst is used in a catalytically effective amount in the compositions and processes herein. By "catalytically effective amount" is meant an amount which is sufficient, under whatever comparative test conditions are employed, to enhance bleaching and removal of the stain or stains of interest from the target substrate. Thus, in a fabric laundering operation, the target substrate will typically be a fabric stained with, for example, various food stains. The test conditions will vary, depending on the type of washing appliance used and the habits of the user. Thus, front-loading laundry washing machines of the type employed in Europe generally use less water and higher detergent concentrations than do top-loading U.S.-style machines. Some machines have considerably longer wash cycles than others. Some users elect to use very hot water; others use warm or even cold water in fabric laundering operations. Of course, the catalytic performance of the bleach catalyst will be affected by such considerations, and the levels of bleach catalyst used in fully-formulated detergent and bleach compositions can be appropriately adjusted. As a practical matter, and

not by way of limitation, the compositions and processes herein can be adjusted to provide on the order of at least one part per ten million of the active bleach catalyst species in the aqueous washing liquor, and will preferably provide from about 0.01 ppm to about 1.0 ppm, more preferably from about 0.03 ppm to about 0.6 ppm, of the manganese sourced by the bleach catalyst in the laundry liquor. To illustrate this point further, on the order of 3 micromolar manganese catalyst is effective at 40°C, pH 10 under European conditions using perborate and a bleach activator (e.g., TAED, benzoyl caprolactam). Conversely, use of a bleach activator and the manganese catalyst with perborate may allow the formulator to achieve equivalent bleaching at lower perborate usage levels than products without the manganese catalyst.

The compositions herein will therefore typically comprise from about 1 ppm to about 1200 ppm of the metal-containing bleach catalyst, preferably from about 5 ppm to about 800 ppm, and more preferably from about 10 ppm to about 600 ppm. Most preferred compositions comprise the bleach catalyst $\text{Mn}^{\text{IV}}_2(\text{u-O})_3(1,4,7\text{-trimethyl-1,4,7-triazacyclononane})_2(\text{PF}_6)_2$ in a concentration of from about 30 ppm to about 1000 ppm, preferably from about 30 ppm to about 650 ppm, more preferably from about 30 ppm to about 500 ppm.

The Agent capable of binding Manganese - The detergent compositions herein also contain one or more agents capable of binding manganese, which should contain in their molecule at least three nitrogen atoms or at least two nitrogen atoms and one oxygen atom, and be non-cyclic. Ligands such as disclosed in e.g. EPA 549 271, are therefore not encompassed by the present definition. Such agents can be represented by well known chelating agents used in detergent compositions. Such chelating agents can be selected from the group consisting of amino carboxylates, amino phosphonates and mixtures therein. These materials are actually used in detergent compositions because of their exceptional ability to remove iron and manganese ions from the washing solutions by formation of soluble chelates.

Amino carboxylates useful as chelating agents include ethylenediaminetetracetates, N-hydroxyethylethylenediamine-triacetates, nitrilotriacetates, ethylenediamine tetrapropionates, triethylenetetraaminehexacetates, diethylenetriamine pentaacetates, and ethanoldiglycines, both in their acid form, or in their alkali metal, ammonium, and substituted ammonium salt forms, and mixtures thereof.

A suitable chelating agent for use herein is also ethylenediamine disuccinate ("EDDS"), especially the [S,S] isomer as described in U.S. Patent 4,704,233, November 3, 1987, to Hartman and Perkins.

Amino phosphonates are also suitable for use as chelating agents and DTPMP (diethylene triamine penta (methylene phosphonic acid)), commercially available under the trade name DEQUEST and salts thereof.

Other agents useful herein which do not contain such carboxylic or phosphonic functional groups include diethylene triamine, pentamethyl diethylene triamine, 1,1',7,7'-tetramethyl-4-hydroxymethyl-diethylene triamine and 1,4,4'-trimethyl-1'-hydroxymethyl ethylene diamine.

Preferred agents for use herein are those which molecule contains at least 3 nitrogen atoms.

Most preferred species for use herein are diethylene triamine penta (methylene phosphonic acid), diethylene triamine pentaacetic acid, triethylene tetraamine hexaacetic acid and diethylene triamine.

The agents capable of binding manganese will generally comprise from about 0.1% to about 10% by weight of the detergent compositions herein, more preferably from about 0.1% to about 3.0% by weight of such compositions.

The metal ion - In one embodiment of the present invention, the compositions herein contain from 0.01 to 2% of a metal ion, selected from magnesium, calcium, strontium, zinc and aluminium; the ion can be incorporated in the composition in the form of a water-soluble salt with anions selected from the group of sulfate, chloride, nitrate, carbonate, acetate or in the form of a complex with the manganese chelating agent.

The intimate mixture - In another embodiment of the present invention, the manganese-containing catalyst and the agent capable of binding manganese are introduced in the composition in the form of an intimate mixture; this may mean that both ingredients are combined with a suitable carrier, for independent incorporation into granular or liquid compositions, or that both ingredients are allowed to form a complex, before incorporation into the composition.

Both embodiments described above do not exclude each-other, i.e. both the metal ion and the intimate mixture described above can be present in the composition.

Optional Ingredients

The Peroxy Compounds

It is to be appreciated that the bleach catalyst does not function as a bleach by itself. Rather, it is used as a catalyst to enhance the performance of conventional bleaches and, in particular, oxygen bleaching agents such as perborate, percarbonate, persulfate, and the like, possibly in the presence of bleach activators. Accordingly, the compositions of the invention which are fully formulated detergent compositions also contain peroxy compounds which as used herein includes bleaching agents and bleaching mixtures containing a bleaching agent and one or more bleach activators, in an amount sufficient to provide bleaching of the stain or stains of interest (e.g., tea stains; wine stains). It has to be understood, however, that the compositions of the invention can also be free of peroxy compounds, when said compositions are used as laundry additive formulations, to be added to peroxy-containing laundry detergent compositions. Bleaching agents will typically be at levels of from about 1% to about 80%, more typically from about 5% to about 20%,

of the detergent composition, especially for fabric laundering. Bleach and pre-soak compositions may comprise from 5% to 99% of the bleaching agent. If present, the amount of bleach activators will typically be from about 0.1% to about 60%, more typically from about 0.5% to about 40% of the bleaching mixture comprising the bleaching agent-plus-bleach activator.

1. Bleaching Agents:

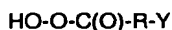
The bleaching agents used herein can be any of the bleaching agents useful for detergent or bleaching compositions in textile cleaning, hard surface cleaning, or other cleaning purposes that are now known or become known, and are useful for bleaching compositions as used in the present invention to treat fabrics. These include oxygen bleaches as well as other bleaching agents. Perborate bleaches, e.g., sodium perborate (e.g., mono- or tetra-hydrate) can be used herein.

Peroxygen bleaching agents are preferably used in the compositions. Suitable peroxygen bleaching compounds include sodium carbonate peroxyhydrate and equivalent "percarbonate" bleaches, sodium pyrophosphate peroxyhydrate, urea peroxyhydrate, and sodium peroxide. Persulfate bleach (e.g., OXONE, manufactured commercially by DuPont) can also be used.

A preferred percarbonate bleach comprises dry particles having an average particle size in the range from about 500 micrometers to about 1,000 micrometers, not more than about 10% by weight of said particles being smaller than about 200 micrometers and not more than about 10% by weight of said particles being larger than about 1,250 micrometers. Optionally, the percarbonate can be coated with silicate, borate or water-soluble surfactants. Percarbonate is available from various commercial sources such as FMC, Solvay and Tokai Denka.

As used herein, bleaching agents also comprise preformed organic percarboxylic acids. Such bleaching agents that can be used without restriction encompass percarboxylic acid bleaching agents and salts thereof. Suitable examples of this class of agents include magnesium monoperoxyphthalate hexahydrate (INTEROX), the magnesium salt of metachloro perbenzoic acid, 4-nonylamino-4-oxoperoxybutyric acid and diperoxidodecanedioic acid. Such bleaching agents are disclosed in U.S. Patent 4,483,781, Hartman, issued November 20, 1984, U.S. Patent Application 740,446, Burns et al, filed June 3, 1985, European Patent Application 0,133,354, Banks et al, published February 20, 1985, and U.S. Patent 4,412,934, Chung et al, issued November 1, 1983. Highly preferred bleaching agents also include 6-nonylamino-6-oxoperoxydecanoic acid (NAPAA) as described in U.S. Patent 4,634,551, issued January 6, 1987 to Burns et al.

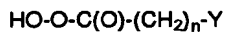
Such materials normally have a general formula:



wherein R is an alkylene or substituted alkylene group containing from 1 to about 22 carbon atoms or a phenylene or substituted phenylene group, and Y is hydrogen, halogen, alkyl, aryl or



The organic percarboxylic acids usable in the present invention can contain either one or two peroxy groups and can be either aliphatic or aromatic. When the organic percarboxylic acid is aliphatic, the unsubstituted acid has the general formula:



where Y can be, for example, H, CH₃, CH₂Cl, COOH, or COOOH; and n is an integer from 1 to 20.

When the organic percarboxylic acid is aromatic, the unsubstituted acid has the general formula:



wherein Y is hydrogen, alkyl, alkyhalogen, halogen, or COOH or COOOH.

Typical monoperoxy percarboxylic acids useful herein include alkyl percarboxylic acids and aryl percarboxylic acids such as:

(i) peroxybenzoic acid and ring-substituted peroxybenzoic acids, e.g., peroxy-o-naphthoic acid;

(ii) aliphatic, substituted aliphatic and arylalkyl monoperoxy acids, e.g. peroxylauric acid, peroxystearic acid, and N,N-phthaloylaminoperoxydecanoic acid (PAP).

Typical diperoxy percarboxylic acids useful herein include alkyl diperoxy acids and aryl diperoxy acids, such as:

(iii) 1,12-diperoxidodecanedioic acid;

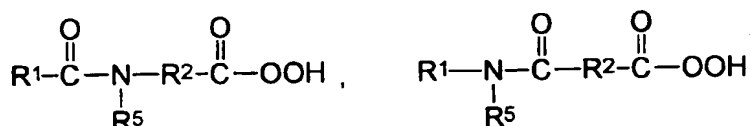
(iv) 1,9-diperoxyazelaic acid;

(v) diperoxybrassylic acid; diperoxysebacic acid and diperoxyisophthalic acid;

(vi) 2-decyldiperoxybutane-1,4-dioic acid;

(vii) 4,4'-sulfonybisperoxybenzoic acid.

The present invention may further encompass bleaching compositions comprising an effective amount of a substantially insoluble organic percarboxylic acid bleaching agent having the general formula:



wherein R¹ is an alkyl, aryl, or alkaryl group containing from about 1 to about 14 carbon atoms, R² is an alkylene, arylene or alkarylene group containing from about 1 to about 14 carbon atoms, and R⁵ is H or an alkyl, aryl, or alkaryl group containing from about 1 to about 10 carbon atoms.

Peroxygen bleaching agents, the perborates, the percarbonates, etc., are preferably combined with bleach activators, which lead to the *in situ* production in aqueous solution (i.e., during the washing process) of the percarboxylic acid corresponding to the bleach activator.

2. Bleach Activators

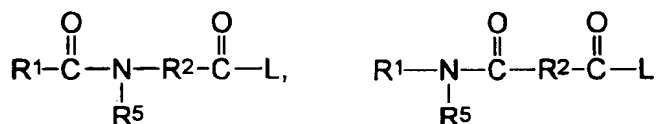
Bleach activators are known and amply described in literature, such as in the GB Patents 836,988; 864,798; 907,356; 1,003,310 and 1,519,351; German Patent 3,337,921; EP-A-0185522; EP-A-0174132; EP-A-0120591; and U.S. Pat. Nos. 1,246,339; 3,332,882; 4,128,494; 4,412,934 and 4,675,393.

A class of bleach activators is that of the quaternary ammonium substituted peroxyacid activators as disclosed in U.S. Pat. Nos. 4,751,015 and 4,397,757, in EP-A-284292, EP-A-331,229 and EP-A-03520. Examples of peroxyacid bleach activators of this class are:

- 2-(N,N,N-trimethyl ammonium) ethyl-4-sulphophenyl carbonate--(SPCC);
- N-octyl,N,N-dimethyl-N 10-carbophenoxy decyl ammonium chloride--(ODC);
- 3-(N,N,N-trimethyl ammonium) propyl sodium-4-sulphophenyl carboxylate; and
- N,N,N-trimethyl ammonium toluoyloxy benzene sulphonate.

Other activators include sodium-4-benzoyloxy benzene sulphonate; N,N,N',N'-tetracetyl ethylene diamine; sodium-1-methyl-2-benzoyloxy benzene-4-sulphonate; sodium-4-methyl-3-benzoyloxy benzoate; sodium nonanoyloxybenzene sulphonate; sodium 3,5,5-trimethyl hexanoyloxybenzene sulphonate; glucose pentaacetate and tetraacetyl xylose.

Bleach activators of interest in the present invention are amide substituted compounds of the general formulas:

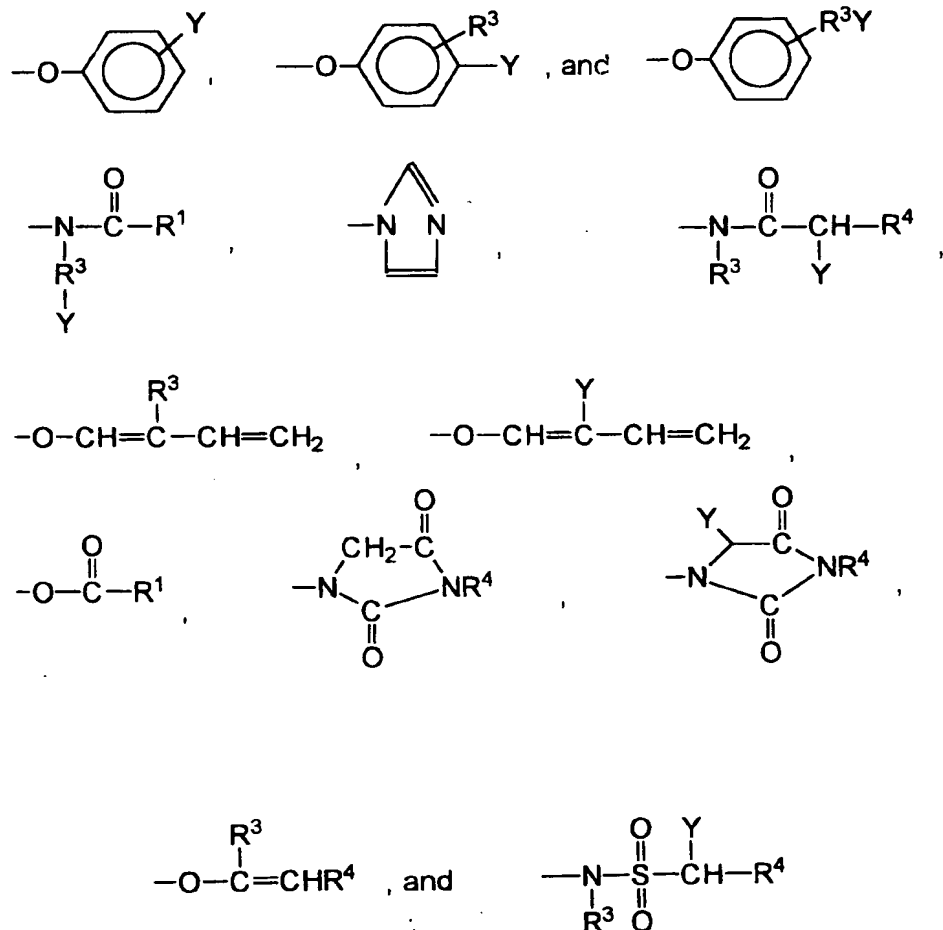


or mixtures thereof, wherein R¹ is an alkyl, aryl, or alkaryl group containing from about 1 to about 14 carbon atoms, R² is an alkylene, arylene or alkarylene group containing from about 1 to about 14 carbon atoms, R⁵ is H or an alkyl, aryl, or alkaryl group containing from about 1 to about 10 carbon atoms, and L can be essentially any suitable leaving group. A leaving group is any group that is displaced from the bleaching activator as a consequence of the nucleophilic attack on the bleach activator by the perhydroxide anion. This, the perhydrolysis reaction, results in the formation of the peroxycarboxylic acid. Generally, for a group to be a suitable leaving group it must exert an electron attracting effect. It should also form a stable entity so that the rate of the back reaction is negligible. This facilitates the nucleophilic attack by the perhydroxide anion.

The L group must be sufficiently reactive for the reaction to occur within the optimum time frame (e.g., a wash cycle). However, if L is too reactive, this activator will be difficult to stabilize for use in a bleaching composition. These characteristics are generally paralleled by the pK_a of the conjugate acid of the leaving group, although exceptions to this con-

vention are known. Ordinarily, leaving groups that exhibit such behavior are those in which their conjugate acid has a pKa in the range of from about 4 to about 13, preferably from about 6 to about 11 and most preferably from about 8 to about 11.

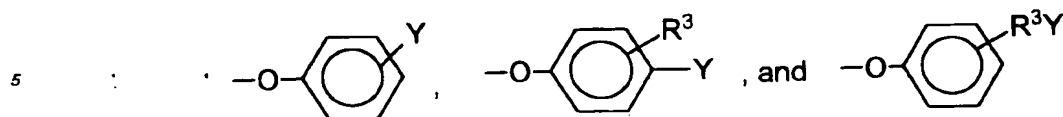
Preferred bleach activators are those of the above general formula wherein R¹, R² and R⁵ are as defined for the peroxyacid and L is selected from the group consisting of:



and mixtures thereof, wherein R¹ is an alkyl, aryl, or alkaryl group containing from about 1 to about 14 carbon atoms, R³ is an alkyl chain containing from 1 to about 8 carbon atoms, R⁴ is H or R³, and Y is H or a solubilizing group.

The preferred solubilizing groups are -SO₃⁻M⁺, -CO₂⁻M⁺, -SO₄⁻M⁺, -N⁺(R³)₄X⁻ and O<-N(R³)₃ and most preferably -SO₃⁻M⁺ and -CO₂⁻M⁺ wherein R³ is an alkyl chain containing from about 1 to about 4 carbon atoms, M is a cation which provides solubility to the bleach activator and X is an anion which provides solubility to the bleach activator. Preferably, M is an alkali metal, ammonium or substituted ammonium cation, with sodium and potassium being most preferred, and X is a halide, hydroxide, methylsulfate or acetate anion. It should be noted that bleach activators with a leaving group that does not contain a solubilizing group should be well dispersed in the bleaching solution in order to assist in their dissolution.

Preferred bleach activators are those of the above general formula wherein L is selected from the group consisting of:



10 wherein R³ is as defined above and Y is -SO₃⁻M⁺ or -CO₂⁻M⁺ wherein M is as defined above.

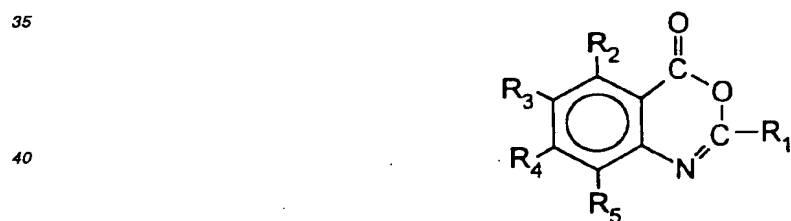
Preferred examples of bleach activators of the above formulae include (6-octanamidocaproyl)oxybenzenesulfonate, (6-nonanamidocaproyl)oxybenzenesulfonate, (6-decanamidocaproyl)oxybenzenesulfonate, and mixtures thereof.

15 Another important class of bleach activators provide organic peracids as described herein by ring-opening as a consequence of the nucleophilic attack on the carbonyl carbon of the cyclic ring by the perhydroxide anion. For instance, this ring-opening reaction in certain activators involves attack at the lactam ring carbonyl by hydrogen peroxide or its anion. Since attack of an acyl lactam by hydrogen peroxide or its anion occurs preferably at the exocyclic carbonyl, obtaining a significant fraction of ring-opening may require a catalyst. Another example of ring-opening bleach activators can be found in other activators, such as those disclosed in U.S. Patent 4,966,723, Hodge et al, issued Oct. 30, 1990.

Such activator compounds disclosed by Hodge include the activators of the benzoxazin-type, having the formula:



30 including the substituted benzoxazins of the type

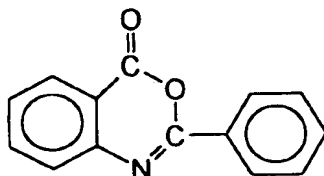


45 wherein R₁ is H, alkyl, alkaryl, aryl, arylalkyl, and wherein R₂, R₃, R₄, and R₅ may be the same or different substituents selected from H, halogen, alkyl, alkenyl, aryl, hydroxyl, alkoxyl, amino, alkyl amino, COOR₆ (wherein R₆ is H or an alkyl group) and carbonyl functions.

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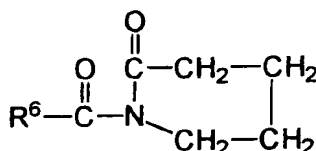
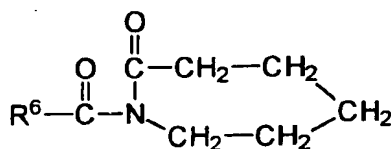
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A preferred activator of the benzoxazin-type is:



When the activators are used, optimum surface bleaching performance is obtained with washing solutions wherein the pH of such solution is between about 8.5 and 10.5 and preferably between 9.5 and 10.5 in order to facilitate the perhydrolysis reaction. Such pH can be obtained with substances commonly known as buffering agents, which are optional components of the bleaching systems herein.

Still another class of preferred bleach activators includes the acyl lactam activators, especially acyl caprolactams and acyl valerolactams of the formulae:



wherein R⁶ is H, an alkyl, aryl, alkoxyaryl, or alkaryl group containing from 1 to about 12 carbon atoms, or a substituted phenyl group containing from about 6 to about 18 carbons. See also U.S. Patent 4,545,784, issued to Sanderson, October 8, 1985, incorporated herein by reference, which discloses acyl caprolactams, including benzoyl caprolactam, adsorbed into sodium perborate.

Various nonlimiting examples of additional activators which may comprise the bleach compositions disclosed herein include those in U.S. Patent 4,915,854, issued April 10, 1990 to Mao et al, and U.S. Patent 4,412,934. The nonanoyloxybenzene sulfonate (NOBS) and tetraacetyl ethylene diamine (TAED) activators are typical, and mixtures thereof can also be used. See also U.S. 4,634,551 for other typical bleaches and activators useful herein.

The superior bleaching/cleaning action of the present compositions is also preferably achieved with safety to natural rubber machine parts and other natural rubber articles, including fabrics containing natural rubber and natural rubber elastic materials. The bleaching mechanism and, in particular, the surface bleaching mechanism are not completely understood. However, it is generally believed that the bleach activator undergoes nucleophilic attack by a perhydroxide anion, which is generated from the hydrogen peroxide evolved by the peroxygen bleach, to form a peroxycarboxylic acid. This reaction is commonly referred to as perhydrolysis.

The amido-derived and lactam bleach activators herein can also be used in combination with preferably rubber-safe, enzyme-safe, hydrophilic activators such as TAED, typically at weight ratios of amido-derived or caprolactam activators:TAED in the range of 1:5 to 5:1, preferably about 1:1.

The compositions herein can optionally include one or more other detergent adjunct materials or other materials for assisting or enhancing cleaning performance, treatment of the substrate to be cleaned, or to modify the aesthetics of the detergent composition (e.g., perfumes, colorants, dyes, etc.). Preferably, the adjunct ingredients should have good stability with the bleaches preferably employed herein. The following are illustrative examples of such adjunct materials.

Free Radical Scavenging Antioxidant Materials:

"Free radical scavenging antioxidant materials", as used optionally herein, means those materials which act to prevent oxidation in products by functioning as free radical scavengers. Examples of antioxidants that can be added to the compositions of this invention include a mixture of ascorbic acid, ascorbic palmitate, propyl gallate, available from Eastman Chemical Products, Inc., under the trade names TenoxR PG and Tenox S-1; a mixture of BHT (butylated hydroxytoluene), BHA (butylated hydroxyanisole), propyl gallate, and citric acid, available from Eastman Chemical Products, Inc., under the trade name Tenox-6; butylated hydroxytoluene, available from UOP Process Division under the trade name SustaneR BHT; tertiary butylhydroquinone, Eastman Chemical Products, Inc., as Tenox TBHQ; natural tocopherols, Eastman Chemical Products, Inc., as Tenox GT-1/GT-2; and butylated hydroxyanisole, Eastman Chemical Products, Inc., as BHA; long chain esters (C₈-C₂₂) of gallic acid, e.g., dodecyl gallate; IrganoxR 1010; IrganoxR 1035; IrganoxR B 1171; IrganoxR 1425; IrganoxR 3114; IrganoxR 3125; mono-tert-butyl hydroquinone (MTBHQ); benzoic acid and salts thereof; toluic acids and salts thereof; t-butyl catechol; 1,1,3-tris(2-methyl-4-hydroxy-5-t-butylphenyl) butane (Tapanol CA available from ICI); monoalkyl ethers of hydroquinone (e.g., 4-methoxyphenol); and mixtures thereof.

Preferred are BHT, BHA, TBHQ, propyl gallate, ascorbic acid, and mixtures thereof.

It is to be recognized that for purposes of the present invention, materials otherwise useful as antioxidants which do not act as free radical scavengers, such as those materials which function solely by chelating metals which can initiate oxidation reactions are not "free radical scavenging antioxidant materials" herein, but are preferred optional material to be used with the free radical scavenging antioxidant materials.

The term "antioxidant effective amount", as used herein, means an amount of a free radical scavenging antioxidant material effective for further reducing, under whatever comparative test conditions are employed, the extent of any fabric damage (including, for example, tensile strength loss and/or color damage) observed by the presence of the metal-containing bleach catalyst in the composition. Such fabric damage may be evaluated under any typical wash conditions, including the greater than 40° C wash conditions common in Europe. Preferred levels of free radical scavenging antioxidant materials to be used in products are therefore easily determined, and are typically present in the compositions according to the present invention within the range of from about 1 ppm to about 2%, preferably from about 20 ppm to about 6000 ppm, and most preferably from about 50 ppm to about 2000ppm. Further, in a powder formulation, the antioxidant may be introduced into the formulation as a powder or through agglomeration or granulation or any other process to keep the catalyst and antioxidant close to each other and thereby allow quick interaction in the wash.

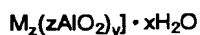
Builders - Detergent builders can optionally be included in the compositions herein to assist in controlling mineral hardness. Inorganic as well as organic builders can be used. Builders are typically used in fabric laundering compositions to assist in the removal of particulate soils.

The level of builder can vary widely depending upon the end use of the composition and its desired physical form. When present, the compositions will typically comprise at least about 1% builder. Liquid formulations typically comprise from about 5% to about 50%, more typically about 5% to about 30%, by weight, of detergent builder. Granular formulations typically comprise from about 10% to about 80%, more typically from about 15% to about 50% by weight, of the detergent builder. Lower or higher levels of builder, however, are not meant to be excluded.

Examples of silicate builders are the alkali metal silicates, particularly those having a SiO₂:Na₂O ratio in the range 1.6:1 to 3.2:1 and layered silicates, such as the layered sodium silicates described in U.S. Patent 4,664,839, issued May 12, 1987 to H. P. Rieck. NaSKS-6 is the trademark for a crystalline layered silicate marketed by Hoechst (commonly abbreviated herein as "SKS-6"). Unlike zeolite builders, the Na SKS-6 silicate builder does not contain aluminum. NaSKS-6 has the delta-Na₂SiO₅ morphology form of layered silicate. It can be prepared by methods such as those described in German DE-A-3,417,649 and DE-A-3,742,043. SKS-6 is a highly preferred layered silicate for use herein, but other such layered silicates, such as those having the general formula NaMSi_xO_{2x+1} · yH₂O wherein M is sodium or hydrogen, x is a number from 1.9 to 4, preferably 2, and y is a number from 0 to 20, preferably 0 can be used herein. Various other layered silicates from Hoechst include NaSKS-5, NaSKS-7 and NaSKS-11, as the alpha, beta and gamma forms. As noted above, the delta-Na₂SiO₅ (NaSKS-6 form) is most preferred for use herein. Other silicates may also be useful such as for example magnesium silicate, which can serve as a crispening agent in granular formulations, as a stabilizing agent for oxygen bleaches, and as a component of suds control systems.

Examples of carbonate builders are the alkaline earth and alkali metal carbonates as disclosed in German Patent Application No. 2,321,001 published on November 15, 1973.

Aluminosilicate builders are useful in the present invention. Aluminosilicate builders are of great importance in most currently marketed heavy duty granular detergent compositions, and can also be a significant builder ingredient in liquid detergent formulations. Aluminosilicate builders include those having the empirical formula:



wherein z and y are integers of at least 6, the molar ratio of z to y is in the range from 1.0 to about 0.5, and x is an integer from about 15 to about 264.

Useful aluminosilicate ion exchange materials are commercially available. These aluminosilicates can be crystalline or amorphous in structure and can be naturally-occurring aluminosilicates or synthetically derived. A method for producing aluminosilicate ion exchange materials is disclosed in U.S. Patent 3,985,669, Krummel, et al, issued October 12, 1976. Preferred synthetic crystalline aluminosilicate ion exchange materials useful herein are available under the designations Zeolite A, Zeolite P (B), Zeolite MAP and Zeolite X. In an especially preferred embodiment, the crystalline aluminosilicate ion exchange material has the formula:



wherein x is from about 20 to about 30, especially about 27. This material is known as Zeolite A. Dehydrated zeolites (x = 0 - 10) may also be used herein. Preferably, the aluminosilicate has a particle size of about 0.1-10 microns in diameter.

Organic detergent builders suitable for the purposes of the present invention include, but are not restricted to, a wide variety of polycarboxylate compounds. As used herein, "polycarboxylate" refers to compounds having a plurality of carboxylate groups, preferably at least 3 carboxylates. Polycarboxylate builder can generally be added to the composition in acid form, but can also be added in the form of a neutralized salt. When utilized in salt form, alkali metals, such as sodium, potassium, and lithium, or alkanolammonium salts are preferred.

Included among the polycarboxylate builders are a variety of categories of useful materials. One important category of polycarboxylate builders encompasses the ether polycarboxylates, including oxydisuccinate, as disclosed in Berg, U.S. Patent 3,128,287, issued April 7, 1964, and Lamberti et al, U.S. Patent 3,635,830, issued January 18, 1972. See also "TMS/TDS" builders of U.S. Patent 4,663,071, issued to Bush et al, on May 5, 1987. Suitable ether polycarboxylates also include cyclic compounds, particularly alicyclic compounds, such as those described in U.S. Patents 3,923,679; 3,835,163; 4,158,635; 4,120,874 and 4,102,903.

Citrate builders, e.g., citric acid and soluble salts thereof (particularly sodium salt), are polycarboxylate builders of particular importance for detergent formulations due to their availability from renewable resources and their biodegradability. Citrates can be used in liquids or in granular compositions, especially in combination with zeolite and/or layered silicate builders. Oxydisuccinates are also especially useful in such compositions and combinations.

Fatty acids, e.g., C₁₂-C₁₈ monocarboxylic acids, can also be incorporated into the compositions alone, or in combination with the aforesaid builders, especially citrate and/or the succinate builders, to provide additional builder activity. Such use of fatty acids will generally result in a diminution of sudsing, which should be taken into account by the formulator.

In situations where phosphorus-based builders can be used, and especially in the formulation of bars used for hand-laundering operations, the various alkali metal phosphates such as the well-known sodium tripolyphosphates, sodium pyrophosphate and sodium orthophosphate can be used.

Detergent Surfactants - Nonlimiting examples of surfactants useful herein typically at levels from about 1% to about 55%, by weight, include the conventional C₁₁-C₁₈ alkyl benzene sulfonates ("LAS") and primary, branched-chain and random C₁₀-C₂₀ alkyl sulfates ("AS"), the C₁₀-C₁₈ secondary (2,3) alkyl sulfates of the formula CH₃(CH₂)_x(CHOSO₃⁻M*)CH₃ and CH₃(CH₂)_y(CHOSO₃⁻M*)CH₂CH₃ where x and (y + 1) are integers of at least about 7, preferably at least about 9, and M is a water-solubilizing cation, especially sodium, unsaturated sulfates such as oleyl sulfate, the C₁₀-C₁₈ alkyl alkoxy sulfates ("AES"; especially EO 1-7 ethoxy sulfates), C₁₀-C₁₈ alkyl alkoxy carboxylates (especially the EO 1-5 ethoxycarboxylates), the C₁₀-18 glycerol ethers, the C₁₀-C₁₈ alkyl polyglycosides and their corresponding sulfated polyglycosides, and C₁₂-C₁₈ alpha-sulfonated fatty acid esters. If desired, the conventional nonionic and amphoteric surfactants such as the C₁₂-C₁₈ alkyl ethoxylates ("AE") including the so-called narrow peaked alkyl ethoxylates and C₈-C₁₂ alkyl phenol alkoxyates (especially ethoxylates and mixed ethoxy/propoxy), C₁₂-C₁₈ betaines and sulfobetaines ("sultaines"), C₁₀-C₁₈ amine oxides, and the like, can also be included in the overall compositions. The C₁₀-C₁₈ N-alkyl polyhydroxy fatty acid amides can also be used. Typical examples include the C₁₂-C₁₈ N-methylglucamides. See WO 9,206,154. Other sugar-derived surfactants include the N-alkoxy polyhydroxy fatty acid amides, such as C₁₀-C₁₈ N-(3-methoxypropyl) glucamide. The N-propyl through N-hexyl C₁₂-C₁₈ glucamides can be used for low sudsing. C₁₀-C₂₀ conventional soaps may also be used. If high sudsing is desired, the branched-chain C₁₀-C₁₆ soaps may be used. Mixtures of anionic and nonionic surfactants are especially useful. Other conventional useful surfactants are listed in standard texts.

Suitable nonionic surfactants particularly suitable for dishcare are the low-foaming or non-foaming ethoxylated straight-chain alcohols such as Plurafac™ RA series, supplied by Eurane Co., Lutensol™ LF series, supplied by BASF Co., Triton™ DF series, supplied by Rohm & Haas Co., and Synperonic™ LF series, supplied by ICI Co.

Clay Soil Removal/Anti-redeposition Agents - The compositions of the present invention can also optionally contain water-soluble ethoxylated amines having clay soil removal and antiredeposition properties. Granular detergent compositions which contain these compounds typically contain from about 0.01% to about 10.0% by weight of the water-soluble ethoxylated amines; liquid detergent compositions typically contain about 0.01% to about 5%.

The most preferred soil release and anti-redeposition agent is ethoxylated tetraethylenepentamine. Exemplary ethoxylated amines are further disclosed in U.S. Patent 4,597,898, VanderMeer, issued July 1, 1986. Another group of

preferred clay soil removal-antiredeposition agents are the cationic compounds disclosed in European Parent Application 111,965, Oh and Gosselink, published June 27, 1984. Other clay soil removal/antiredeposition agents which can be used include the ethoxylated amine polymers disclosed in European Patent Application 111,984, Gosselink, published June 27, 1984; the zwitterionic polymers disclosed in European Patent Application 112,592, Gosselink, published July 4, 1984; and the amine oxides disclosed in U.S. Patent 4,548,744, Connor, issued October 22, 1985. Other clay soil removal and/or anti redeposition agents known in the art can also be utilized in the compositions herein. Another type of preferred antiredeposition agent includes the carboxy methyl cellulose (CMC) materials. These materials are well known in the art.

Polymeric Dispersing Agents - Polymeric dispersing agents can advantageously be utilized at levels from about 0.1% to about 7%, by weight, in the compositions herein, especially in the presence of zeolite and/or layered silicate builders. Suitable polymeric dispersing agents include polymeric polycarboxylates and polyethylene glycols, although others known in the art can also be used. It is believed, though it is not intended to be limited by theory, that polymeric dispersing agents enhance overall detergent builder performance, when used in combination with other builders (including lower molecular weight polycarboxylates) by crystal growth inhibition, particulate soil release peptization, and anti-redeposition.

Polymeric polycarboxylate materials can be prepared by polymerizing or copolymerizing suitable unsaturated monomers, preferably in their acid form. Unsaturated monomeric acids that can be polymerized to form suitable polymeric polycarboxylates include acrylic acid, maleic acid (or maleic anhydride), fumaric acid, itaconic acid, aconitic acid, mesaconic acid, citraconic acid and methylenemalononic acid. The presence in the polymeric polycarboxylates herein or monomeric segments, containing no carboxylate radicals such as vinylmethyl ether, styrene, ethylene, etc. is suitable provided that such segments do not constitute more than about 40% by weight.

Particularly suitable polymeric polycarboxylates can be derived from acrylic acid. Such acrylic acid-based polymers which are useful herein are the water-soluble salts of polymerized acrylic acid. The average molecular weight of such polymers in the acid form preferably ranges from about 2,000 to 10,000, more preferably from about 4,000 to 7,000 and most preferably from about 4,000 to 5,000. Water-soluble salts of such acrylic acid polymers can include, for example, the alkali metal, ammonium and substituted ammonium salts. Soluble polymers of this type are known materials. Use of polyacrylates of this type in detergent compositions has been disclosed, for example, in Diehl, U.S. Patent 3,308,067, issued March 7, 1967.

Acrylic/maleic-based copolymers may also be used as a preferred component of the dispersing/anti-redeposition agent. Such materials include the water-soluble salts of copolymers of acrylic acid and maleic acid. The average molecular weight of such copolymers in the acid form preferably ranges from about 2,000 to 100,000, more preferably from about 5,000 to 75,000, most preferably from about 7,000 to 65,000. The ratio of acrylate to maleate segments in such copolymers will generally range from about 30:1 to about 1:1, more preferably from about 10:1 to 2:1. Water-soluble salts of such acrylic acid/maleic acid copolymers can include, for example, the alkali metal, ammonium and substituted ammonium salts. Soluble acrylate/maleate copolymers of this type are known materials which are described in European Patent Application No. 66915, published December 15, 1982.

Another polymeric material which can be included is polyethylene glycol (PEG). PEG can exhibit dispersing agent performance as well as act as a clay soil removal-antiredeposition agent. Typical molecular weight ranges for these purposes range from about 500 to about 100,000, preferably from about 1,000 to about 50,000, more preferably from about 1,500 to about 10,000.

Polyaspartate and polyglutamate dispersing agents may also be used, especially in conjunction with zeolite builders. Dispersing agents such as polyaspartate preferably have a molecular weight (avg.) of about 10,000.

Enzymes - Enzymes can be included in the formulations herein for a wide variety of fabric laundering purposes, including removal of protein-based, carbohydrate-based, or triglyceride-based stains, for example, and for the prevention of refugee dye transfer, and for fabric restoration. The enzymes to be incorporated include proteases, amylases, lipases, cellulases, and peroxidases, as well as mixtures thereof. Other types of enzymes may also be included. They may be of any suitable origin, such as vegetable, animal, bacterial, fungal and yeast origin. However, their choice is governed by several factors such as pH-activity and/or stability optima, thermostability, stability versus active detergents, builders and so on. In this respect bacterial or fungal enzymes are preferred, such as bacterial amylases and proteases, and fungal cellulases.

Enzymes are normally incorporated at levels sufficient to provide up to about 5 mg by weight, more typically about 0.01 mg to about 3 mg, of active enzyme per gram of the composition. Stated otherwise, the compositions herein will typically comprise from about 0.001% to about 5%, preferably 0.01%-1% by weight of a commercial enzyme preparation. Protease enzymes are usually present in such commercial preparations at levels sufficient to provide from 0.005 to 0.1 Anson units (AU) of activity per gram of composition.

Suitable examples of proteases are the subtilisins which are obtained from particular strains of *B. subtilis* and *B. licheniformis*. Another suitable protease is obtained from a strain of *Bacillus*, having maximum activity throughout the pH range of 8-12, developed and sold by Novo Industries A/S under the registered trade name ESPERASE. The preparation of this enzyme and analogous enzymes is described in British Patent Specification No. 1,243,784 of Novo. Proteolytic

enzymes suitable for removing protein-based stains that are commercially available include those sold under the trade-names ALCALASE and SAVINASE by Novo Industries A/S (Denmark) and MAXATASE by International Bio-Synthetics, Inc. (The Netherlands). Other proteases include Protease A (see European Patent Application 130,756, published January 9, 1985) and Protease B (see European Patent Application Serial No. 87303761.8, filed April 28, 1987, and European Patent Application 130,756, Bott et al, published January 9, 1985).

Amylases include, for example, α -amylases described in British Patent Specification No. 1,296,839 (Novo), RAPIDASE, International Bio-Synthetics, Inc. and TERMAMYL, Novo Industries.

The cellulase usable in the present invention include both bacterial or fungal cellulase. Preferably, they will have a pH optimum of between 5 and 9.5.

Suitable lipase enzymes for detergent usage include those produced by microorganisms of the *Pseudomonas* group, such as *Pseudomonas stutzeri* ATCC 19,154, as disclosed in British Patent 1,372,034. See also lipases in Japanese Patent Application 53,20487, laid open to public inspection on February 24, 1978. This lipase is available from Amano Pharmaceutical Co. Ltd., Nagoya, Japan, under the trade name Lipase P "Amano," hereinafter referred to as "Amano-P." Other commercial lipases include Amano-CES, lipases ex *Chromobacter viscosum*, e.g. *Chromobacter viscosum* var. *lipolyticum* NRRLB 3673, commercially available from Toyo Jozo Co., Tagata, Japan; and further *Chromobacter viscosum* lipases from U.S. Biochemical Corp., U.S.A. and Disoynt Co., The Netherlands, and lipases ex *Pseudomonas gladioli*. The LIPOLASE enzyme derived from *Humicola lanuginosa* and commercially available from Novo (see also EPO 341,947) is a preferred lipase for use herein.

Peroxidase enzymes are used in combination with oxygen sources, e.g., percarbonate, perborate, persulfate, hydrogen peroxide, etc. They are used for "solution bleaching," i.e. to prevent transfer of dyes or pigments removed from substrates during wash operations to other substrates in the wash solution. Peroxidase enzymes are known in the art, and include, for example, horseradish peroxidase, ligninase, and haloperoxidase such as chloro- and bromo-peroxidase. Peroxidase-containing detergent compositions are disclosed, for example, in PCT International Application WO 89/099813, published October 19, 1989, by O. Kirk, assigned to Novo Industries A/S.

A wide range of enzyme materials and means for their incorporation into synthetic detergent compositions are also disclosed in U.S. Patent 3,553,139, issued January 5, 1971 to McCarty et al. Enzymes are further disclosed in U.S. Patent 4,101,457, Place et al, issued July 18, 1978, and in U.S. Patent 4,507,219, Hughes, issued March 26, 1985, both. Enzyme materials useful for liquid detergent formulations, and their incorporation into such formulations, are disclosed in U.S. Patent 4,261,868, Hora et al, issued April 14, 1981. Enzymes for use in detergents can be stabilized by various techniques. Enzyme stabilization techniques are disclosed and exemplified in U.S. Patent 3,600,319, issued August 17, 1971 to Gedge, et al, and European Patent Application Publication No. 0 199 405, Application No. 86200586.5, published October 29, 1986, Venegas. Enzyme stabilization systems are also described, for example, in U.S. Patent 3,519,570.

Brightener - Any optical brighteners or other brightening or whitening agents known in the art can be incorporated at levels typically from about 0.05% to about 1.2%, by weight, into the detergent compositions herein. Commercial optical brighteners which may be useful in the present invention can be classified into subgroups, which include, but are not necessarily limited to, derivatives of stilbene, pyrazoline, coumarin, carboxylic acid, methinecyanines, dibenzothiphenes, 5,5-dioxide, azoles, 5- and 6-membered-ring heterocycles, and other miscellaneous agents. Examples of such brighteners are disclosed in "The Production and Application of Fluorescent Brightening Agents", M. Zahradnik, Published by John Wiley & Sons, New York (1982).

Specific examples of optical brighteners which are useful in the present compositions are those identified in U.S. Patent 4,790,856, issued to Wixon on December 13, 1988. These brighteners include the PHORWHITE series of brighteners from Verona. Other brighteners disclosed in this reference include: Tinopal UNPA, Tinopal CBS and Tinopal 5BM; available from Ciba-Geigy; Artic White CC and Artic White CWD, available from Hilton-Davis, located in Italy; the 2-(4-stryl-phenyl)-2H-naphtho[1,2-d]triazoles; 4,4'-bis- (1,2,3-triazol-2-yl)-stilbenes; 4,4'-bis(stryl)bisphenyls; and the amino-coumarins. Specific examples of these brighteners include 4-methyl-7-diethyl- amino coumarin; 1,2-bis(venzinidazol-2-yl)ethylene; 1,3-diphenyl-phrazolines; 2,5-bis(benzoxazol-2-yl)thiophene; 2-stryl-naph-[1,2-d]oxazole; and 2-(stilbene-4-yl)-2H-naphtho- [1,2-d]triazole. See also U.S. Patent 3,646,015, issued February 29, 1972 to Hamilton. Anionic brighteners are preferred herein.

Suds Suppressors - Compounds for reducing or Suppressing the formation of suds can be incorporated into the compositions of the present invention. Suds suppression can be of particular importance in the so-called "high concentration cleaning process" and in front-loading European-style washing machines.

A wide variety of materials may be used as suds suppressors, and suds suppressors are well known to those skilled in the art. See, for example, Kirk Othmer Encyclopedia of Chemical Technology, Third Edition, Volume 7, pages 430-447 (John Wiley & Sons, Inc., 1979). One category of suds suppressor of particular interest encompasses monocarboxylic fatty acid and soluble salts therein. See U.S. Patent 2,954,347, issued September 27, 1960 to Wayne St. John. The monocarboxylic fatty acids and salts thereof used as suds suppressor typically have hydrocarbyl chains of 10 to about 24 carbon atoms, preferably 12 to 18 carbon atoms. Suitable salts include the alkali metal salts such as sodium, potassium, and lithium salts, and ammonium and alkanolammonium salts.

The detergent compositions herein may also contain non-surfactant suds suppressors. These include, for example: high molecular weight hydrocarbons such as paraffin, fatty acid esters (e.g., fatty acid triglycerides), fatty acid esters of monovalent alcohols, aliphatic C₁₈-C₄₀ ketones (e.g., stearone), etc. Other suds inhibitors include N-alkylated amino triazines such as tri- to hexa-alkylmelamines or di- to tetra-alkyldiamine chlortriazines formed as products of cyanuric chloride with two or three moles of a primary or secondary amine containing 1 to 24 carbon atoms, propylene oxide, and monostearyl phosphates such as monostearyl alcohol phosphate ester and monostearyl di-alkali metal (e.g., K, Na, and Li) phosphates and phosphate esters. The hydrocarbons such as paraffin and haloparaffin can be utilized in liquid form. The liquid hydrocarbons will be liquid at room temperature and atmospheric pressure, and will have a pour point in the range of about -40°C and about 50°C, and a minimum boiling point not less than about 110°C (atmospheric pressure). It is also known to utilize waxy hydrocarbons, preferably having a melting point below about 100°C. The hydrocarbons constitute a preferred category of suds suppressor for detergent compositions. Hydrocarbon suds suppressors are described, for example, in U.S. Patent 4,265,779, issued May 5, 1981 to Gandolfo et al. The hydrocarbons, thus, include aliphatic, alicyclic, aromatic, and heterocyclic saturated or unsaturated hydrocarbons having from about 12 to about 70 carbon atoms. The term "paraffin," as used in this suds suppressor discussion, is intended to include mixtures of true paraffins and cyclic hydrocarbons.

Another preferred category of non-surfactant suds suppressors comprises silicone suds suppressors. This category includes the use of polyorganosiloxane oils, such as polydimethylsiloxane, dispersions or emulsions of polyorganosiloxane oils or resins, and combinations of polyorganosiloxane with silica particles wherein the polyorganosiloxane is chemisorbed or fused onto the silica. Silicone suds suppressors are well known in the art and are, for example, disclosed in U.S. Patent 4,265,779, issued May 5, 1981 to Gandolfo et al and European Patent Application No. 89307851.9, published February 7, 1990, by Starch, M. S.

Other silicone suds suppressors are disclosed in U.S. Patent 3,455,839 which relates to compositions and processes for defoaming aqueous solutions by incorporating therein small amounts of polydimethylsiloxane fluids.

Mixtures of silicone and silanated silica are described, for instance, in German Patent Application DOS 2,124,526. Silicone defoamers and suds controlling agents in granular detergent compositions are disclosed in U.S. Patent 3,933,672, Bartolotta et al, and in U.S. Patent 4,652,392, Baginski et al, issued March 24, 1987.

An exemplary silicone based suds suppressor for use herein is a suds suppressing amount of a suds controlling agent consisting essentially of:

- (i) polydimethylsiloxane fluid having a viscosity of from about 20 cs. to about 1,500 cs. at 25°C;
- (ii) from about 5 to about 50 parts per 100 parts by weight of (i) of siloxane resin composed of (CH₃)₃SiO_{1/2} units of SiO₂ units in a ratio of from (CH₃)₃SiO_{1/2} units and to SiO₂ units of from about 0.6:1 to about 1.2:1; and
- (iii) from about 1 to about 20 parts per 100 parts by weight of (i) of a solid silica gel.

In the preferred silicone suds suppressor used herein, the solvent for a continuous phase is made up of certain polyethylene glycols or polyethylene-polypropylene glycol copolymers or mixtures thereof (preferred), or polypropylene glycol. The primary silicone suds suppressor is branched/crosslinked and preferably not linear.

To illustrate this point further, typical liquid laundry detergent compositions with controlled suds will optionally comprise from about 0.001 to about 1, preferably from about 0.01 to about 0.7, most preferably from about 0.05 to about 0.5, weight % of said silicone suds suppressor, which comprises (1) a nonaqueous emulsion of a primary antifoam agent which is a mixture of (a) a polyorganosiloxane, (b) a resinous siloxane or a silicone resin-producing silicone compound, (c) a finely divided filler material, and (d) a catalyst to promote the reaction of mixture components (a), (b) and (c), to form silanates; (2) at least one nonionic silicone surfactant; and (3) polyethylene glycol or a copolymer of polyethylene-polypropylene glycol having a solubility in water at room temperature of more than about 2 weight %; and without polypropylene glycol. Similar amounts can be used in granular compositions, gels, etc. See also U.S. Patents 4,978,471, Starch, issued December 18, 1990, and 4,983,316, Starch, issued January 8, 1991, 5,288,431, Huber et al., issued February 22, 1994, and U.S. Patents 4,639,489 and 4,749,740, Aizawa et al at column 1, line 46 through column 4, line 35.

The silicone suds suppressor herein preferably comprises polyethylene glycol and a copolymer of polyethylene glycol/polypropylene glycol, all having an average molecular weight of less than about 1,000, preferably between about 100 and 800. The polyethylene glycol and polyethylene/polypropylene copolymers herein have a solubility in water at room temperature of more than about 2 weight %, preferably more than about 5 weight %.

The preferred solvent herein is polyethylene glycol having an average molecular weight of less than about 1,000, more preferably between about 100 and 800, most preferably between 200 and 400, and a copolymer of polyethylene glycol/polypropylene glycol, preferably PPG 200/PEG 300. Preferred is a weight ratio of between about 1:1 and 1:10, most preferably between 1:3 and 1:6, of polyethylene glycol:copolymer of polyethylene-polypropylene glycol.

The preferred silicone suds suppressors used herein do not contain polypropylene glycol, particularly of 4,000 molecular weight. They also preferably do not contain block copolymers of ethylene oxide and propylene oxide, like PLURONIC L101.

Other suds suppressors useful herein comprise the secondary alcohols (e.g., 2-alkyl alkanols) and mixtures of such alcohols with silicone oils, such as the silicones disclosed in U.S. 4,798,679, 4,075,118 and EP 150,872. The secondary alcohols include the C₆-C₁₈ alkyl alcohols having a C₁-C₁₈ chain. A preferred alcohol is 2-butyl octanol, which is available from Condea under the trademark ISOFOL 12. Mixtures of secondary alcohols are available under the trademark ISAL-
 5 GHEM 123 from Enichem. Mixed suds suppressors typically comprise mixtures of alcohol + silicone at a weight ratio of 1:5 to 5:1.

For any detergent compositions to be used in automatic laundry washing machines, suds should not form to the extent that they overflow the washing machine. Suds suppressors, when utilized, are preferably present in a "suds suppressing amount. By "suds suppressing amount" is meant that the formulator of the composition can select an amount
 10 of this suds controlling agent that will sufficiently control the suds to result in a low-sudsing laundry detergent for use in automatic laundry washing machines.

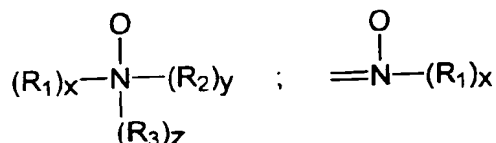
The compositions herein will generally comprise from 0% to about 5% of suds suppressor. When utilized as suds suppressors, monocarboxylic fatty acids, and salts therein, will be present typically in amounts up to about 5%, by weight, of the detergent composition. Preferably, from about 0.5% to about 3% of fatty monocarboxylate suds suppressor is utilized. Silicone suds suppressors are typically utilized in amounts up to about 2.0%, by weight, of the detergent composition, although higher amounts may be used. This upper limit is practical in nature, due primarily to concern with keeping costs minimized and effectiveness of lower amounts for effectively controlling sudsing. Preferably from about 0.01% to about 1% of silicone suds suppressor is used, more preferably from about 0.25% to about 0.5%. As used herein, these weight percentage values include any silica that may be utilized in combination with polyorganosiloxane,
 20 as well as any adjunct materials that may be utilized. Monostearyl phosphate suds suppressors are generally utilized in amounts ranging from about 0.1% to about 2%, by weight, of the composition. Hydrocarbon suds suppressors are typically utilized in amounts ranging from about 0.01% to about 5.0%, although higher levels can be used. The alcohol suds suppressors are typically used at 0.2%-3% by weight of the finished compositions.

Fabric Softeners - Various through-the-wash fabric softeners, especially the impalpable smectite clays of U.S. Patent
 25 4,062,647, Storm and Nirschl, issued December 13, 1977, as well as other softener clays known in the art, can optionally be used typically at levels of from about 0.5% to about 10% by weight in the present compositions to provide fabric softener benefits concurrently with fabric cleaning. Clay softeners can be used in combination with amine and cationic softeners as disclosed, for example, in U.S. Patent 4,375,416, Crisp et al, March 1, 1983 and U.S. Patent 4,291,071, Harris et al, issued September 22, 1981.

Dye Transfer Inhibiting Agents - The compositions of the present invention may also include one or more materials effective for inhibiting the transfer of dyes from one fabric to another during the cleaning process. Generally, such dye transfer inhibiting agents include polyvinyl pyrrolidone polymers, polyamine N-oxide polymers, copolymers of N-vinylpyrrolidone and N-vinylimidazole, manganese phthalocyanine, peroxidases, and mixtures thereof. If used, these agents typically comprise from about 0.01% to about 10% by weight of the composition, preferably from about 0.01% to about
 35 5%, and more preferably from about 0.05% to about 2%.

More specifically, the polyamine N-oxide polymers preferred for use herein contain units having the following structural formula: R-A_x-P; wherein P is a polymerizable unit to which an N-O group can be attached or the N-O group can form part of the polymerizable unit or the NO group can be attached to both units; A is one of the following structures: -NC(O)-, -C(O)O-, -S-, -O-, -N=; x is 0 or 1; and R is aliphatic, ethoxylated aliphatics, aromatics, heterocyclic or alicyclic groups or any combination thereof to which the nitrogen of the N-O group can be attached or the N-O group is part of these groups. Preferred polyamine N-oxides are those wherein R is a heterocyclic group such as pyridine, pyrrole, imidazole, pyrrolidine, piperidine and derivatives thereof.

The N-O group can be represented by the following general structures:



wherein R₁, R₂, R₃ are aliphatic, aromatic, heterocyclic or alicyclic groups or combinations thereof; x, y and z are 0 or
 55 1; and the nitrogen of the N-O group can be attached or form part of any of the aforementioned groups. The amine oxide unit of the polyamine N-oxides has a pK_a <10, preferably pK_a <7, more preferred pK_a <6.

Any polymer backbone can be used as long as the amine oxide polymer formed is water-soluble and has dye transfer inhibiting properties. Examples of suitable polymeric backbones are polyvinyls, polyalkylenes, polyesters, polyethers, polyamide, polyimides, polyacrylates and mixtures thereof. These polymers include random or block copolymers where

one monomer type is an amine N-oxide and the other monomer type is an N-oxide. The amine N-oxide polymers typically have a ratio of amine to the amine N-oxide of 10:1 to 1:1,000,000. However, the number of amine oxide groups present in the polyamine oxide polymer can be varied by appropriate copolymerization or by an appropriate degree of N-oxidation. The polyamine oxides can be obtained in almost any degree of polymerization. Typically, the average molecular weight is within the range of 500 to 1,000,000; more preferred 1,000 to 500,000; most preferred 5,000 to 100,000.

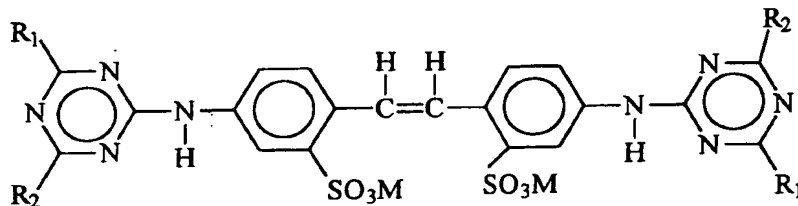
The most preferred polyamine N-oxide useful in the detergent compositions herein is poly(4-vinylpyridine-N-oxide) which as an average molecular weight of about 50,000 and an amine to amine N-oxide ratio of about 1:4.

Copolymers of N-vinylpyrrolidone and N-vinylimidazole polymers (referred to as a class as "PVPVI") are also preferred for use herein. Preferably the PVPVI has an average molecular weight range from 5,000 to 1,000,000, more preferably from 5,000 to 200,000, and most preferably from 10,000 to 20,000. (The average molecular weight range is determined by light scattering as described in Barth, et al., *Chemical Analysis*, Vol 113, "Modern Methods of Polymer Characterization", the disclosures of which are incorporated herein by reference.) The PVPVI copolymers typically have a molar ratio of N-vinylimidazole to N-vinylpyrrolidone from 1:1 to 0.2:1, more preferably from 0.8:1 to 0.3:1, most preferably from 0.6:1 to 0.4:1. These copolymers can be either linear or branched.

The present invention compositions also may employ a polyvinylpyrrolidone ("PVP") having an average molecular weight of from about 5,000 to about 400,000, preferably from about 5,000 to about 200,000, and more preferably from about 5,000 to about 50,000. PVP's are known to persons skilled in the detergent field; see, for example, EP-A-262,897 and EP-A-256,696, incorporated herein by reference. Compositions containing PVP can also contain polyethylene glycol ("PEG") having an average molecular weight from about 500 to about 100,000, preferably from about 1,000 to about 10,000. Preferably, the ratio of PEG to PVP on a ppm basis delivered in wash solutions is from about 2:1 to about 50:1, and more preferably from about 3:1 to about 10:1.

The detergent compositions herein may also optionally contain from about 0.005% to 5% by weight of certain types of hydrophilic optical brighteners which also provide a dye transfer inhibition action. If used, the compositions herein will preferably comprise from about 0.01% to 1% by weight of such optical brighteners.

The hydrophilic optical brighteners useful in the present invention are those having the structural formula:



wherein R_1 is selected from anilino, N-2-bis-hydroxyethyl and NH-2-hydroxyethyl; R_2 is selected from N-2-bis-hydroxyethyl, N-2-hydroxyethyl-N-methylamino, morphilino, chloro and amino; and M is a salt-forming cation such as sodium or potassium.

When in the above formula, R_1 is anilino, R_2 is N-2-bis-hydroxyethyl and M is a cation such as sodium, the brightener is 4,4'-bis[(4-anilino-6-(N-2-bis-hydroxyethyl)-s-triazine-2-yl)amino]-2,2'-stilbenedisulfonic acid and disodium salt. This particular brightener species is commercially marketed under the tradename Tinopal-UNPA-GX by Ciba-Geigy Corporation. Tinopal-UNPA-GX is the preferred hydrophilic optical brightener useful in the detergent compositions herein.

When in the above formula, R_1 is anilino, R_2 is N-2-hydroxyethyl-N-2-methylamino and M is a cation such as sodium, the brightener is 4,4'-bis[(4-anilino-6-(N-2-hydroxyethyl-N-methylamino)-s-triazine-2-yl)amino]-2,2'-stilbenedisulfonic acid disodium salt. This particular brightener species is commercially marketed under the tradename Tinopal 5BM-GX by Ciba-Geigy Corporation.

When in the above formula, R_1 is anilino, R_2 is morphilino and M is a cation such as sodium, the brightener is 4,4'-bis[(4-anilino-6-morphilino-s-triazine-2-yl)amino]-2,2'-stilbenedisulfonic acid, sodium salt. This particular brightener species is commercially marketed under the tradename Tinopal AMS-GX by Ciba Geigy Corporation.

The specific optical brightener species selected for use in the present invention provide especially effective dye transfer inhibition performance benefits when used in combination with the selected polymeric dye transfer inhibiting agents hereinbefore described. The combination of such selected polymeric materials (e.g., PVNO and/or PVPVI) with such selected optical brighteners (e.g., Tinopal UNPA-GX, Tinopal 5BM-GX and/or Tinopal AMS-GX) provides significantly better dye transfer inhibition in aqueous wash solutions than does either of these two detergent composition components when used alone. Without being bound by theory, it is believed that such brighteners work this way because they have high affinity for fabrics in the wash solution and therefore deposit relatively quick on these fabrics. The extent

to which brighteners deposit on fabrics in the wash solution can be defined by a parameter called the "exhaustion coefficient". The exhaustion coefficient is in general as the ratio of a) the brightener material deposited on fabric to b) the initial brightener concentration in the wash liquor. Brighteners with relatively high exhaustion coefficients are the most suitable for inhibiting dye transfer in the context of the present invention.

Of course, it will be appreciated that other, conventional optical brightener types of compounds can optionally be used in the present compositions to provide conventional fabric "brightness" benefits, rather than a true dye transfer inhibiting effect. Such usage is conventional and well-known to detergent formulations.

Other Ingredients - A wide variety of other ingredients useful in detergent compositions can be included in the compositions herein, including other active ingredients, carriers, hydrotropes, processing aids, dyes or pigments, solvents for liquid formulations, enzyme stabilizers, solid fillers for bar compositions, etc. If high sudsing is desired, suds boosters such as the C₁₀-C₁₆ alkanolamides can be incorporated into the compositions, typically at 1%-10% levels. The C₁₀-C₁₄ monoethanol and diethanol amides illustrate a typical class of such suds boosters. Use of such suds boosters with high sudsing adjunct surfactants such as the amine oxides, betaines and sultaines noted above is also advantageous.

Various deterative ingredients employed in the present compositions optionally can be further stabilized by absorbing said ingredients onto a porous hydrophobic substrate, then coating said substrate with a hydrophobic coating. Preferably, the deterative ingredient is admixed with a surfactant before being absorbed into the porous substrate. In use, the deterative ingredient is released from the substrate into the aqueous washing liquor, where it performs its intended deterative function.

To illustrate this technique in more detail, a porous hydrophobic silica (trademark SIPERNAT D10, Degussa) is admixed with a proteolytic enzyme solution containing 3%-5% of C₁₃₋₁₅ ethoxylated alcohol (EO 7) nonionic surfactant. Typically, the enzyme/surfactant solution is 2.5 X the weight of silica. The resulting powder is dispersed with stirring in silicone oil (various silicone oil viscosities in the range of 500-12,500 can be used). The resulting silicone oil dispersion is emulsified or otherwise added to the final detergent matrix. By this means, ingredients such as the aforementioned enzymes, bleaches, bleach activators, bleach catalysts, photoactivators, dyes, fluorescers, fabric conditioners and hydrolyzable surfactants can be "protected" for use in detergents, including liquid laundry detergent compositions.

Liquid detergent compositions for use herein are typically anhydrous. Such non-aqueous liquid detergent compositions are well known in the art, and normally comprise a non-aqueous medium, in which a solid phase can possibly be dispersed. Such a non-aqueous medium may be a liquid surfactant, preferably a liquid nonionic surfactant, a non-polar liquid medium, such as paraffin, a polar solvent such as polyol, preferably as glycerol, sorbitol, ethylene glycol, optionally combined with low molecular monohydric alcohols, e.g. ethanol or isopropanol, and mixtures thereof. The solid phase can be constituted of builders, alkalis, abrasives, polymers, clays, other solid ionic surfactants, bleaches, fluorescent agents and other usual solid detergent ingredients.

The detergent compositions herein will preferably be formulated such that, during use in aqueous cleaning operations, the wash water will have a pH of between about 6.5 and about 11, preferably between about 7.5 and 10.5. Laundry products are typically at pH 9-11. Techniques for controlling pH at recommended usage levels include the use of buffers, alkalis, acids, etc., and are well known to those skilled in the art.

The present invention also encompasses the use of agents capable of binding manganese, which molecule contains at least 3 nitrogen atoms or at least 2 nitrogen atoms and an oxygen atom, in a molar ratio to the bleach catalyst of from 1:1 to 100:1, to reduce the catalyst induced fabric damage.

In one embodiment herein, the agent capable of binding manganese is used in combination with a metal ion selected from magnesium, calcium, strontium, zinc and aluminium; such a use is particularly found in the washing of white textiles in automatic washing machines.

In another embodiment herein, the use above the agent capable of binding manganese is present as an intimate mixture with the manganese-containing bleach catalyst, such a use is particularly found in the washing of white and colored textiles in automatic washing machines.

The present compositions have also been found to give benefits in terms of soil removal properties, and their use for such a purpose is also encompassed herein.

The following examples illustrate compositions according to the invention, but are not intended to be limiting thereof.

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EXAMPLES

The following granular detergent compositions according to the invention were prepared :

<u>Ingredient</u>	<u>part by weight</u>				
<u>Examples</u>	1	2	3	4	5
Linear Alkyl Benzene Suphonate	7	0	0	0	0
Tallow Alkyl Sulphate	3	0	0	0	0
Alkyl Sulphate	0	9	6	9	12
Alkyl Ethoxylate Sulphate	0.2	2	1	2	2
Alkyl Ethoxylate(5 of 7 times ethoxylated)	4	5	10	6	4
Alkyl-N-Methyl Glucosamide	0	2	3	3	1
Percarbonate	18	22	19	22	24
(6-ocanamido-capryol) oxybenzene sulfonate	0	5	0	0	0
Benzoyl Caprolactam	0	0	2	5	0
N-[4-(trimethyl ammonium ethyl benzoyl)caprolactam, chloride salt	0	0	0	0	4
N,N,N,N-Tetra acetyl ethylene diamine (TAED)	5	0	2	5	0
Diethylene triamine pentaacetic acid (DTPA)	0	0	0	0.5	0.5
Diethylene triamine penta (methylene phosphonic acid) DTPMP	0.6	0.6	0	0	0
Mn catalyst *	0.03	0.02	0	0.04	0.005
Magnesium Sulfate, 7H2O	0.8	0.6	0	1.00	0.8
Mn catalyst/DTPMP complex	0	0	0.6	0	0
Alumino Silicate (zeolite A)	21	13	15	15	18
Layered Silicate	0	12	11	11	9
Sodium Citrate	6	5	4	4	3
Sodium Carbonate	16	8	7	7	7
Sodium Silicate	3	0	0	0	0
Sodium Sulphate	4	0.6	0.6	0.6	0.6
Minors	up to 100				

* $Mn^{IV}_2(u-O)_3(1,4,7\text{-trimethyl-}1,4,7\text{-triazacyclononane})_2-(PF_6)_2$

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The following anhydrous liquid detergent composition according to the invention was prepared :

Ingredient	Part by weight
	Ex. 6
Alkyl ethoxylate (6.5 times alkoxyated)	27
Alkyl ethoxylate (3 times ethoxylated)	22
Linear Alkylbenzene sulphonic acid	6
Sodium carbonate	17
Calcite	6
Polymer	1.5
Carboxy methyl cellulose	1.5
Silica	4.5
Brightener	0.2
Antifoam agent	1.6
Sodium perborate	10.5
Diethylene triamine pentaacetic acid (DTPA)	0.8
Magnesium sulfate	0.9
Mn Catalyst*	0.02

* $Mn^{IV}_2(u-O)_3(1,4,7\text{-trimethyl-1,4,7-triazacyclononane})_2(PF_6)_2$

The Mn catalyst can be incorporated by dissolving the catalyst in a biopolymer as described in patent WO 94/1263.

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Comparative data

The following compositions were prepared :

Ingredients	Composition A	Ex. 7	Ex. 8
Tallow sodium alkyl sulfate	5.7	5.7	5.7
Nonionic detergent	11.7	11.7	11.7
Zeolite P	38.2	38.2	38.2
Sodium carbonate	7.2	7.2	7.2
Silicate	5.4	5.4	5.4
Percarbonate	17	17	17
TAED	3.5	3.5	3.5
Brightener	0.1	0.1	0.1
Sodium Sulfate	1.6	1.6	1.6
Mn Catalyst	0.03	0.03	0
Magnesium Sulfate	0	1.0	1.0
Diethylene triamine penta (methylene phosphonic acid) DTPMP	0	0.6	0
Mn catalyst/DTPMP complex	0	0	0.8
Minors	Up to 100		

1. The fabric damage-reduction performance of the composition of Example 7 on white items was compared to reference composition A. Standard Krefeld white cotton swatches (WFK TestGewebe, Germany) were washed in European washing machines with the above compositions. Fabric damage was evaluated by measuring tensile strength loss (TSL). TSL were quantitated according to standard procedure as described in International Standard ISO 4312. The weight loss percent of the tensile strength is calculated vs. an original unwashed swatch. Swatches were washed at both 60°C (up to 30 cycles) and 90°C (up to 20 cycles). The shown numbers are the average of 15 different Krefeld swatches. Results are statistically significant at 95% confidence.

Results were as follows :

% Tensile Strength Loss results :

at 60°C			
Number of cycles	10	20	30
Example 7	18±3	24±2	24±2
Composition A	23±5	31±6	34±3
at 90°C			
Number of cycles	5	10	20
Example 7	14±4	18±4	22±3
Composition A	17±3	28±3	45±3

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2. The fabric damage reduction effect of the composition of Example 8 on colored items was compared to reference composition A. Fabric damage was assessed on standard color cottons. Three replicate of each cotton swatches were washed in European washing machines with the above compositions. Damage was evaluated by examining each swatche for tears after every cycle. Swatches were washed at 60°C. Cotton used was mercerized waven cotton with a density of 300g/m².

Results were as follows :

The effect also reduces damage on colored items, on cotton Number of cycles needed to produce tears :

	Composition A	Ex. 8
Blue cotton	25 ± 1	none after 40 cycles
Brown cotton	24 ± 1	none after 40 cycles

3. The stain removal performance of the above composition 7 was also assessed, using the following procedure : Using a launder-o-meter, at 40°C isothermal, tea-stained test clothes were immersed for 30 minutes in each of the compositions A and Ex. 7. (Detergent formulation was dosed at 6g/l.)

After rinsing with tap water, the clothes were dried and the stain removal was assessed by a Hunter Colour measurement. The Hunter Colour system evaluates the colour of a fabric sample in terms of the DE value which represents the change in the Hunter L, a, b, values which are determined by reflecting spectrometrie. The DE value is defined by the following equation :

$$DE = \{ (a_i - a_f)^2 + (b_i - b_f)^2 + (L_i - L_f)^2 \}^{1/2}$$

where the subscripts i and f refer to the Hunter value before and after washing (in the presence of the bleeding fabric, respectively). The least significant difference is 2 at 95% confidence level.

The larger the ΔE, the better the stain removal.

Results were as follows :

Using a composition without catalyst as reference

	ΔE
Comp. A	37.8
Ex. 7	47.0

Claims

1. A laundry bleaching composition comprising a manganese-containing bleach catalyst, characterized in that the composition further contains a non-cyclic agent capable of binding manganese, which molecule contains at least 3 nitrogen atoms or at least 2 nitrogen atoms and an oxygen atom, in a molar ratio to the bleach catalyst of from 0.2:1 to 500:1, and that the composition further contains from 0.01 to 2% of a metal ion selected from magnesium, calcium, strontium, zinc and aluminium, and/or the manganese-containing bleach catalyst and the agent capable of binding manganese are present as an intimate mixture.
2. A composition according to claim 1, said molar ratio of the agent capable of complexing manganese to the bleach catalyst is of from 1:1 to 250:1.

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3. A composition according to claim 1 wherein said agent capable of complexing manganese contains at least 3 nitrogen atoms in its molecule.
- 5 4. A composition according to claim 3 wherein said agent is selected from the group of amino carboxylates and amino phosphonates.
5. A composition according to claim 4 wherein said agent is selected from the group of diethylene triamine pentaacetic acid, triethylene tetramine hexaacetic acid, diethylene triamine penta (methylene phosphonic acid).
- 10 6. A composition according to claim 3 wherein said agent is diethylene triamine.
7. A composition according to claims 1-6 wherein the composition contains magnesium ion.
- 15 8. A composition according to claims 1-7 wherein the catalyst is $\text{Mn}^{\text{IV}}_2(\text{u-O})_3(1,4,7\text{-trimethyl-}1,4,7\text{-triazacyclononane})_2(\text{PF}_6)_2$.
9. A composition according to claims 1-8 which also contains a peroxy compound.
- 20 10. A composition according to claims 1-6 wherein the peroxy compound comprises perborate, percarbonate, and mixtures thereof.
11. A composition according to claim 9 wherein the peroxy compound comprises a bleach activator.
- 25 12. A composition according to claims 10 and 11 which is a detergent composition, further comprising a surfactant and a builder.
13. A composition according to claim 1 which is in the form of a laundry additive in laundry bleaching compositions containing a manganese-containing bleach catalyst.
- 30 14. A composition according to claim 13 which further comprises a peroxy compound.
15. The use of an agent capable of binding manganese, which molecule contains at least 3 nitrogen atoms or at least 2 nitrogen atoms and an oxygen atom, in a molar ratio to the bleach catalyst of from 1:1 to 100:1, to reduce the catalyst-induced fabric damage.
- 35 16. The use of claim 15 wherein the agent capable of binding manganese is used in combination with a metal ion selected from magnesium, calcium, strontium, zinc and aluminium.
- 40 17. The use of claim 15 wherein the agent capable of binding manganese is present as an intimate mixture with the manganese-containing bleach catalyst.
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European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 87 0206

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	FR-A-2 453 212 (UNILEVER NV) * page 3, line 2 - line 37 * * page 4, line 34 - line 37 * * examples * * claims *	1-17	C11D3/39 C11D3/36
D,Y	EP-A-0 549 272 (UNILEVER PLC ET AL.) * page 8, line 38 - line 39 * * claims *	1-17	
A	EP-A-0 072 166 (PROCTER & GAMBLE CO.) * abstract *	1	
A	EP-A-0 172 602 (INTEROX CHEMICAL LTD) * claims *	1	
A	EP-A-0 279 282 (INTEROX SOCIÉTÉ ANONYME) * claims *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			C11D
The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 29 May 1995	Examiner Pelli Wablat, B
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

EPO FORM 150 (04/92) (PACH)